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Successful CONOPS of Modernized Hellfire

CONCEPT MOVES TO NEXT STAGE OF DEVELOPMENT

Pilots *used view moving maps on the simulated F/A-18E Horizontal Situation Indicator during the Modernized Hellfire CONOPS evaluation.*

Imagine a new missile designed to replace, and to combine the capabilities of, three existing missiles. Now imagine that your new missile is designed to be launched from Marine or Navy helicopters and from fixed-wing aircraft.

Imagination has always been a key asset for weapons designers, but before relatively recent improvements in computer modeling and simulation, such an imagined missile might have been met with, "You gotta be dreamin'." And a wild dream it would have been, because the cost to develop even a concept prototype would have been prohibitive.

But in the the spring of 2001 just such a dream weapon was "flown" successfully, as imagination became images and other computer models and simulations in the NAVAIR Weapons Division's Integrated Battlespace ARena (IBAR). Modernized Hellfire went up against a variety of targets, through a number of threat systems, in two geographical locations and in varying weather conditions, launched from two versions of F/A-18 and from JSF. Using principally the reconfigurable cockpit and out-the-window display of IBAR's Virtual Prototyping Facility (VPF) and the computing might of its High Performance Computing Distributed Center (HPCDC), the engineers of IBAR and four different pilots ran a concept-of-operation (CONOPS) evaluation exercise from fixed-wing aircraft for the missile.

But no such missile exists.

Services Cooperate in Concept Testing

The Navy and Marine Corps want to replace the current Maverick, Hellfire and TOW (Tube-launched, Optically tracked, Wire-guided) missiles with Modernized Hellfire. Currently, imaging infrared or semi-active laser-guided (SAL) versions of Maverick are launched from fixed-wing aircraft and TOW and laser-guided Hellfire are launched from helicopters.

TOW and Hellfire are small and short-range missiles, designed to be used against tanks, but both are also effective against other ground targets. Maverick is relatively large and medium-range, and it's used against armored and non-armored vehicles, patrol boats, bunkers and aircraft shelters.

The Navy and Marine Corps want to combine these capabilities into one missile to replace the current systems. They envision many acquisition, logistics and life-cycle maintenance benefits by managing just one system with expanded capabilities that can be fired from both the fixed-wing and rotary-wing platforms.

The Army, a user of Hellfire from helicopters and TOW from ground vehicles, wants similar benefits by developing a single missile that can be fired from both the ground and air. Their new conceptual missile is called Common Missile. Planning is underway to try to bring together the Modernized Hellfire and Common Missile programs.

Inter-service cooperation is already taking place, as the Army provided the computer model of the missile to the IBAR for the Modernized Hellfire evaluation. The Army ran a similar CONOPS exercise for rotary-wing aircraft, using the same computer model of the Common Missile, at the Advanced Prototyping, Engineering and Experimentation (APEX) lab. APEX is similar to the VPF, but more suited to rotary-wing aircraft.

Local Hellfire system engineer, Greg Wildman, of the WD Tactical Weapons Program Office, knowing IBAR's capabilities, lobbied with NAVAIR PMA-242 and won the funding to bring the fixed-wing evaluation to the Weapons Division.

"Since the Army already had the rotary-wing prototyping capability at the APEX, NAVAIR hired them to model the Cobra helicopter for the evaluations for the Marine Corps," Wildman said of the cooperation between the services.

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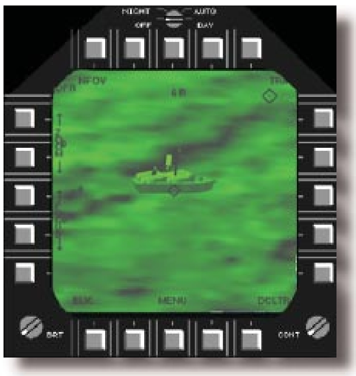

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Various Groups Contribute to Scenarios

PMA-242 contracted with Whitney, Bradley and Brown (WB&B) to take the lead in developing the scenarios that would be run at IBAR and APEX. John Auborn and Andy Corzine, IBAR systems engineers, who worked with WB&B representatives on developing the scenarios, explained that three types of missions — anti-surface warfare (ASUW), close air support and interdiction — were modeled. Additionally, a variety of weather conditions were simulated. To make the scenarios more realistic they enlisted Bob Mount and other personnel from the WD Warfare Analysis Department, who gave them the information necessary to help model targets and threats. The group provided data on where to place threats on the map, and they ran a mission analysis level computer model to generate guidance to the VPF modelers on threat system performance for both the land and sea based scenarios. Others in the team generated Joint Munitions Effectiveness Manual data for the new Hellfire warhead.

In each scenario, one of IBAR's SGI Onyx systems was used to model the aircraft's IR and radar sensors and to generate and display target imagery to the pilot. To provide the pilot with this imagery, new multispectral terrain and target databases were created on another Onyx using satellite and aerial photos of two geographical areas in Southwest Asia. Maps of these areas were also piped into the cockpit display. New weapons interfaces were designed and added to allow the pilot to properly select and engage the target using either semi-active laser guidance or an autonomous millimeter wave (MMW) seeker. The Army's missile model was integrated into the VPF via a networked PC using Distributed Interactive Simulation messages to control targeting and launch of the missile, and to share position and orientation data for all the moving targets.

The computing capacity and modeling and simulation expertise in the IBAR allowed the project to be completed in short order. Andy Corzine noted that all of the modeling and simulation preparation work was completed in less than three months.

IBAR's Flexibility Allows Many, Varied Missions

One scenario had an F/A-18 pilot flying combat air patrol around a carrier group when he detects a small guided-missile boat coming out to attack the ships. He must respond, selecting the correct operational mode for the new missile to neutralize the threat. Just such a real-world combat situation points up the Navy's need for an air-to-ground weapon that pilots can use to react to unknown, unplanned threats.

In all, some 60 different missions were flown using the new CONOPS for Modernized Hellfire. Some in ASUW scenarios similar to the example above, others in support of ground troops and still others with the Navy aircraft running point on interdiction strike scenarios.

"That's the beauty of the lab (the VPF)," said Corzine. "We can load up different aircraft, different ranges to targets, varying weather conditions and put a number of different operational pilots in the cockpit and give them the choice of selecting the different seeker modes, to truly provide a realistic set of combat scenarios a weapon system might see. And we can develop and fly these many missions in a very short time."

Until the VPF and APEX facilities put the man in the loop, actually letting a warfighter dry run the missile, this new weapon was just a concept on paper. But the pilots' comments and impressions provided valuable insight and proved that the CONOPS were feasible.

IBAR's VPF, its HPCDC and other facilities and capabilities have improved upon imagination. The next step of the effort is now underway, with the missions and results from both the VPF and APEX concept-of-operations evaluations being incorporated into further engagement level modeling. Whether Modernized Hellfire and Common Missile will become a single system remains to be seen, but with such facilities and capabilities, weapons designers can now explore all of the possibilities while they're still in the imagination phase.